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Awareness of Single and Multiple Emotions in High-functioning Children with Autism

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Abstract This study examined emotional awareness in children with autism. Twenty-two high functioning children with autism (mean age 10 years and 2 months) and 22 typically developing children, matched for age and gender, were presented with the four basic emotions (happiness, anger, sadness and fear) in single and multiple emotion tasks. Findings suggest that children with autism have difficulties identifying their own emotions and less developed emotion concepts (which causes an impaired capacity to differentiate between one's emotions within the negative spectrum). The outcome seems to point more to a single emotion perspective within the negative domain, with a more prominent position of fear in children with autism than in typically developing children.

Keywords Autism · Emotional awareness · HFA · Emotion concepts · Emotions · Fear

Introduction

The difficulties that children from the autistic spectrum have in understanding other people's mental states are

widely documented; their mind-reading abilities are hampered by a dysfunctional theory of mind (e.g. Baron-Cohen, Tager-Flusberg, & Cohen, 2000; Frith, 2003). Much less is known about their awareness of their own mental states. It can be argued that a functional theory of mind is also necessary to understand your own functioning (Frith, 2003; Happé, 1994). For example, primary emotional reactions are caused by involuntary processes, which can only be understood by post hoc analyses that include more than just the objective situation (Nisbett & Wilson, 1977). Despite many years of quarrelling with your older sister, you might still feel upset and left behind when she moves out of your parents' house to study in another city. The most obvious conclusion then is: "I must have some positive feelings for her" or even "I really miss these quarrels". Primary emotions are clearly the result of one's (not necessarily conscious) personal attitudes to a situation. They may therefore help to reach a better understanding of the desires and beliefs that underlie this attitude. Without a functional theory of mind, children from the autistic spectrum are probably hampered in making these kinds of self-evaluations. Establishing the specific nature of one's affective state is considered to be the first step in this analysis (Schachter & Singer, 1962), and we might even question whether children with autism will make this attempt to label their emotions. Feeling *bad* in the example above, allows for less specific inferences than feeling *sad*.

Emotion Awareness in Children with Autism

Although children with autism are known to be less emotionally expressive in social situations (Attwood, Frith, & Hermelin 1988; Langdell, 1978), they do

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exhibit more emotions to non-living objects (Snow, Hertzog, & Shapiro, 1987). Therefore, children with autism might not strategically use or even fully appreciate the communicative value of emotional expressions, but there is no reason to assume that they are less emotional than other children. However, an emotional state does not automatically imply emotional awareness. Monitoring one's own emotional processes is an ability that children have to learn (Harris, 1989; Selman, 1981). Since the activity of the emotional "core system" (Levenson, 1999) is not open to introspection, the awareness of an active emotion is probably based on not much more than the detection of bodily and behavioural signals in combination with the evaluation of the actual situation in which they arise; an observed contingency that is promoted by remarks of knowledgeable others. These others tend to use certain labels for these combinations of phenomena ("Why are you trembling? Don't be *afraid* of the dog, he doesn't bite"). Even learning this "simple" act of labelling emotions requires that a child combines introspective information, his own behavioural observations, and the (frequently implicit) verbal information provided by others (Harris & Olthof, 1982).

The emotion concept gradually becomes a mental phenomenon in normal development. Six-year-old children tend to answer a question like "How do you know that you are happy?" by "When you are laughing" or "When it is your birthday", which contain observable elements like expressive behaviour and eliciting situations. In contrast, the typical answer of older children and adults is "You are happy when you feel happy inside" (Harris, Olthof, & Meerum Terwogt, 1981). Nonetheless, it is hardly possible to explain exactly what it is that you are feeling. There is probably much less direct information to gain from introspection than we are inclined to think. Cognitive emotion theorists will predict that, next to some rather ambiguous physiological signals such as an accelerated heartbeat, we become aware of a primitive "action tendency" (Frijda, 1986). For example, fear reveals itself by the tendency to run away. The interpretation (e.g. "I'm afraid of that dog") is, as argued before, based on a cognitive post hoc analysis that aims to link this primary emotional reaction to situational circumstances (Lazarus & Folkman, 1984; Levenson, 1999). Therefore, the tendency to primarily regard emotions as inner processes reveals a new theoretical conception: people are autonomic organisms that express their relation to the outside world by thoughts and feelings. Without a fully functional theory of mind, it might be questionable whether we will find the same development in children with autism. A theory of mind

stresses that people make a personal representation of the objective world. Without such a representational conception it is not *you* that is afraid of the dog, but the dog that is scary; this is a subtle difference that can have large implications, for instance in the realm of emotion regulation strategies (Meerum Terwogt & Olthof, 1989; Meerum Terwogt & Stegge, 1995).

If "being afraid" is not essentially different from "being in a scary situation" for children with autism, one would expect that they can link emotions to situational characteristics, especially when—as in the tasks that are presented in this paper—we limit ourselves to high functioning children with autism, who are well able to make use of the information presented by verbal communication. Children from the autistic spectrum have been shown in previous studies to understand the link between the four basic emotions, fear, anger, happiness and sadness, and their eliciting events (Baron-Cohen, 1991; Dennis, Lockyer, & Lazenby, 2000; Rieffe, Meerum Terwogt, & Stockmann, 2000). Almost without exception, 10-year-old high-functioning children predicted correctly how someone would feel if his or her favourite pet was ill (Rieffe et al., 2000). However, these are the kind of prototypical connections that are usually stressed by verbal communication. They use the fear label in connection with big scary dogs, and seldom in connection with little furry hamsters, even though these animals might create fear in *some* children. Only through introspection or the careful observation of others, one will be able to find out that there are always exceptions to the rule. Yet, children with autism are known to neglect the emotional expressions of others (Begeer, Rieffe, Meerum Terwogt, & Stockmann, 2006; Jennings, 1974; Weeks & Hobson, 1987).

Capps, Yirmiya, and Sigman (1992) asked these kinds of questions and found that nearly all high-functioning children with autism were able to provide understandable examples. The few exceptions did not differ between the group with autism and the control group. It has to be noted though that the experimenter recalled a time in which she had felt the emotion when a child was unable to provide an example. The study does not report how often this occurred. (The study by Capps and colleagues showed that reflective emotions like pride and embarrassment were more problematic, but the origin of this finding lies outside the questions we want to address in this study.) In another study, Jaedicke, Storoschuk, and Lord (1994) looked at the number of times that children with autism and a matched control group referred to another person when asked what made them feel happy, angry, sad, scared and worried. Overall, they found that children with

autism were as able as the control group to give descriptions of the various emotions, but their examples less often referred to social interactions. Unfortunately, the authors did not look to the five emotions separately. Moreover, the study included high and lower functioning children with autism who were compared to normally developing control children and children with learning difficulties.

Multiple Emotions

Additionally, it is important to note that apart from a few prototypical situations, nearly all situations in real life can be regarded from different perspectives. You can feel angry with a friend who falsely blames you in front of an adult for breaking one of your toys, but also sad about losing the beloved object. Situations like this less obviously appeal to scripted knowledge about emotions. Young children tend to stop their analysis when they have discovered one of the perspectives (Meerum Terwogt, Koops, Oosterhoff, & Olthof, 1986). Around the age of nine, children typically start to acknowledge the existence of simultaneous emotion perspectives; first the possibility of same-valence emotions (it is possible to be angry and sad at the same time) and, somewhat later, also the possibility of simultaneous emotions of an opposite valence (e.g. happy because you are going to the zoo, but sad because your parents don't allow you to bring your friend along) (Harter & Whitesell, 1989). Even in a study that is limited to the same four basic emotions, the acknowledgement of mixed emotions clearly asks for a higher level of emotional awareness. Moreover, the ability to regard one and the same situation from different perspectives is an ability that is also closely related to a theory of mind: it requires the acknowledgement that one can have different representations of an undivided reality.

Study Aims

In the present experiment, our first aim is to examine the ability of high functioning children with autism to produce concrete examples of emotion evoking situations from their own experiences. In accordance with earlier studies (Capps et al., 1992; Jaedicke et al., 1994), we expect no differences in this study between normally developing children and children with autism with respect to their ability to provide plausible situations in which they have experienced one of the basic emotions happiness, sadness, anger, and fear. We will analyse the children's responses in two ways. First, we will examine the extent to which children use their own

experience as a frame of reference, e.g. "Last week, when I had a fight with my brother." If children with autism derive their emotion theories mainly from verbal communication, we should expect them to provide more prototypical examples when asked about their own experiences. Second, whether the examples provided are social or non-social will be examined. The social problems of children with autism make it less plausible that they will refer to an example of a situation in this domain, as was shown in the results of the study by Jaedicke et al. (1994).

The second aim is to examine whether high functioning children with autism are aware of the multiple emotional impacts of situations that contain different emotional perspectives. Children will be presented with a second task which is focussed on situations with a mixed emotional impact. If possible awareness discrepancies between children with autism and their peers are still concealed in the first task regarding single emotions, they may surface in these more demanding mixed conditions. Instead of interviewing children about their knowledge of multiple emotions, researchers in other studies presented normally developing children with emotion-evoking vignettes and asked if they would feel angry, happy, sad or scared (Meerum Terwogt et al., 1986; Wintre & Valance, 1994). The fact that this method is less dependent on verbal abilities might contribute to the finding that the awareness of mixed emotions typically arises somewhat earlier in these circumstances (i.e. around the age of eight; Wintre & Valance, 1994). In the second task of the present experiment we opted for this latter approach, because children's verbal ability factor is often mentioned as an unintended bottleneck in the experiments with children with autism (e.g. Boucher, 1996). We expected children from the autistic spectrum to detect fewer emotional perspectives.

Method

Participants

Twenty-two children with autism (20 boys, 2 girls) and 22 normally developing children (20 boys, 2 girls) participated in this study. Written parental consent was obtained for all children who participated in this study. The children with autism came from four primary special schools for high-functioning children with autism in Greater London. The schools were all located at middle to high socio-economic areas. All children were diagnosed with Autism (5) or Asperger syndrome (17) by a child psychiatrist or a clinical psychologist using DSM-IV

criteria, prior to their attendance at the schools. Since children with Asperger syndrome are difficult to distinguish from children with autism, most researchers regard them as equivalent (Micali, Chakrabarti, & Fombonne, 2001; Mayes & Calhoun, 2003, 2004). Therefore, both groups will be referred to as children with autism in this study. The mean age of this group was 10 years and 2 months ($SD = 1$ year and 5 months). Only children with no other known disabilities were included. To ensure that the children with autism participating in this study were of average or higher intelligence and that their verbal skills were good enough to enable them to understand the vignettes and test questions with which they were presented, teachers selected children from their classes to participate based on their verbal abilities. Additionally, a non-verbal test was administered (Raven's Coloured Progressive Matrices Test, 1984) and confirmed an average non-verbal intelligence (Mean = 46.68) for this group.

The children in the control group (mean age 10 years and 3 months, $SD = 1$ year and 5 months) were recruited from one primary school in Dublin, which was located in a lower socio-economic area. Children were not explicitly tested for their intelligence, but teachers were asked to choose children with average or good verbal skills in order to correspond with the autism group. Other inclusion criteria specified that the children's native language was English, that they had no learning disabilities or other disorders that their teachers were aware of.

Materials

Emotion Identification

As an introduction, the experimenter first asked children to identify pride. Although the findings from Capps et al. (1992) did not suggest that children with autism reached a perfect understanding of this complex emotion—similar to the findings with young children (Harris, 1989) for whom pride is often confounded with happiness—these authors also reported that children with autism did not find it difficult to provide answers. Therefore, the emotion served in our study as a useful preliminary question, which also created better balance between negative and positive emotions. Responses to this question were not included in the analyses. The four basic emotions that followed were then presented in random order so as to tease out potential order effects of the emotions.

In order to see the extent to which children acknowledge their own emotional experiences, children were asked the following questions:

“..... [name child], do you feel [emotion] sometimes?” (question 1)

“Can you tell me about the last time you felt..... [emotion]?”

What happened, why were you..... [emotion]?” (question 2)

“I would also like to know how..... [emotion] you felt.

Can you show me on this scale how..... [emotion] you felt?” (question 3)

A 5-point scale was introduced to children in order for them to respond to question 3:

“Look, if you felt *very very* proud, you take the highest bar in this scale. And if you felt just a *tiny little bit* proud, you point at the lowest bar. You could also feel *quite* proud, and that might be somewhere in the middle. So, just try to think which one fits best how you felt.”

Scoring

The content of children's examples given by each emotion (question 2) were coded twice. First, responses were categorised as social or non-social. The social impact of an event is sometimes hard to decide. For example, the answer “when I get a present” (reason for happiness) might refer to the present itself (non-social), but can also be connected to the act of giving (social). In order to get a univocal criterion, only explicit references to another person were coded “social”. For example “when my brother gives me a present”.

Second, references to a specific situation or event were taken as an indication that children were using their own experiences as a frame of reference instead of relying on scripted knowledge about emotion-evoking events. Children's answers to question 2 were thus coded as specific or non-specific. Two raters coded transcripts of children's responses independently. The interrater agreement was 96%. Differences were solved by discussion.

Multiple Emotions

This task was directly copied from the Multiple Emotions task designed by Meerum Terwogt et al. (1986). Children were first given an introduction in which they were asked to imagine that the event in the stories had happened to them:

“Now I'll tell you some stories about things that might not have happened to you, but I want you

to listen carefully and try to imagine what it would be like if they really happened to you. Ok? After each story, I'll ask you how you would feel if it really happened to you. And there are no right or wrong answers, I just want to know what children of your age think about these stories."

The task was then introduced by an example story (accompanied by a drawing) and an explicit instruction was given to inform children about the possibility of experiencing more than one emotion simultaneously:

"Imagine, you have a cat and you are very fond of her. You play with her a lot and she always sleeps in your room. But she has been ill for the last few days. It looks like it is her stomach. You take her to the vet. "Yes", the vet says, "it is awful but I have to operate on her". "But after the operation", he says, "she will be well and healthy again and she will have no pain anymore".

So imagine this happened to you. Now some children would feel totally nothing. But other children would have a sad feeling and nothing else. And other children might even have more than one feeling, for example sad and happy. I would like to know which feelings you would have, but everything is possible. You might have no feelings, or you might even have a lot of different feelings."

Drawings of facial expressions that matched the four emotions they were asked about were placed in front of the children. Children were asked: "What do you think, would you feel sad (angry, happy, scared)?" (question 1). Children could respond verbally or non-verbally by pointing at one of the faces. When children responded positively to a particular emotion, they were asked: "Okay, and how sad (angry, happy, scared) would you feel?" (question 2). The same scale as in the Emotion Identification task was used. The four emotions were asked about in random order.

Children were then presented with four stories that were taken from Meerum Terwogt et al. study (1986). Two stories were designed to evoke a positive as well as a negative emotion (the intended combinations were happiness and sadness) and two stories were designed to evoke a mixture of negative emotions (the intended combinations were anger and sadness) (see Appendix: Multiple emotions vignettes). However, since it is virtually impossible to avoid alternative perspectives to multiple emotion scripts that evoke emotions other than the ones intended, we did not discriminate between "correct" and "incorrect" answers. All four basic emotion responses were considered permissible

in each script, which also included fear. To avoid too many stories with a negative impact, two filler stories were included that were designed to evoke happiness only. Children's responses to these stories were not part of the design and were not included in the analyses. Similar to the Meerum Terwogt et al. study (1986), all stories were accompanied by simple black and white drawings.

Procedure

Children were taken from their classroom to a separate room by a female experimenter. Each session took approximately 20 min. Children's responses were tape-recorded. Transcripts of children's responses were used to score their answers after the session. Following a short introduction by the experimenter, the experimenter asked the children's permission to record the session. All children agreed to this. Children tried out the tape recorder at the beginning of each session by saying their name and their age. Then they were shown the cards with the faces that were used in the Multiple Emotions task and asked to point to the angry, happy, sad and scared face. No children showed any difficulties in matching the emotion and the corresponding facial expression. Following this, children were asked the questions for the Emotion Identification task. Finally, they were presented with the stories and the pictures of the Multiple Emotions task.

Results

Data Analyses

Children's responses to the Single Emotions task were analysed in two ways. First, the scores were collapsed over the four emotions, which allowed parametric testing. Second, the emotions were looked at separately. Responses to these questions were dichotomous (yes/no), therefore, non-parametric statistics were applied to analyse these data for each emotion, with the exception of the emotion intensities.

Single Emotions

The first question addressed was whether children with autism acknowledge the experience of their own emotions to the same extent as normally developing children. Children were asked if they sometimes experienced sadness, happiness, anger and fear (question 1). The number of children that answered

affirmative to each of these questions is depicted by the n 's in Table 1. Collapsed over four emotions, children with autism more often denied that they had ever experienced one or more of these emotions than the control group (Mean = 3.14 ($SD = 1.04$) and Mean = 3.59 ($SD = .67$), respectively, $T(42) = 1.73$, $P \leq .045$). All 22 children in each group reported feeling happy sometimes. Within the control group, that was also the case for anger. The difference between groups is due to the negative emotions, which were reported less frequently by the children with autism. Three autistic boys even claimed to have never experienced any of the three negative emotions. Separate χ^2 -tests showed that only Anger differed between the two groups ($\chi^2 = 5.64$, $df = 1$, $P \leq .018$): children with autism acknowledged anger less frequently than children from the control group. Bonferroni correction was applied.

Second, when children acknowledged the emotion, they were asked to provide an occasion in which they had experienced these emotions (question 2). A count of how often they referred to a specific situation was made. Since all answers provided plausible cases for the emotion in question (as judged by two independent raters) none of them was excluded. Collapsed over four emotions, children with autism made fewer references to specific situations than the control group (Mean proportions, respectively, .77 ($SD = .39$) and .96 ($SD = .10$); $T(42) = 2.23$, $P \leq .016$). The mean scores for Group per Emotion are presented in Table 1. These scores are exclusively based on the number of children that claimed to have experienced that particular emotion (question 1, see corresponding n value). When analysed for each emotion separately, again only Anger proved to differ between groups ($\chi^2 = 9.18$, $df = 1$, $P \leq .002$). Bonferroni correction was applied.

Concerning the content of the examples: collapsed over the four emotions, children with autism provided fewer social examples than the control group (Mean proportions, respectively, .25 ($SD = .28$) and .67 ($SD = .25$); $T(40) = 5.14$, $P \leq .001$). Table 2 shows the mean number of references to social situations per group and per emotion. (Note that some of the children, after claiming that they sometimes felt the emotion on the first question, nonetheless failed to provide an example on question 2 this accounts for the differences in n -values between Tables 1 and 2.) When analysed separately for each emotion, the difference between the two groups was significant for Happiness, Anger and Fear (respectively, $\chi^2 = 7.34$, $df = 1$, $P \leq .007$; $\chi^2 = 6.62$, $df = 1$, $P \leq .010$ and $\chi^2 = 7.29$, $df = 1$, $P \leq .007$), but not for Sadness. Bonferroni correction was applied.

With the exception of two children, all children with autism mentioned non-social, idiosyncratic reasons for Happiness (“when I am looking in my science book”), whereas half of the control group referred to interpersonal situations (“when you meet new friends”). All but one child from the control group gave social examples for Anger, whereas only two-thirds of the children with autism did so. However, a common answer in this respect for both groups was getting bullied or teased (90% of the social answers for anger). Sadness was explained in nearly all of the social answers in the autism group by references to a family member (parents fighting, one parent leaving, a parent who had died, being teased by brother or sister). In the control group, half of the answers also referred to a family member, but the other half referred to a problem with a friend. Only one child with autism once mentioned a quarrel with a friend. Another child from the autistic group referred to his condition when

Table 1 Number of children that acknowledged an emotion and mean number of on situation descriptions as a function of Group and Emotion

	“When did you feel...?”											
	Happiness			Anger			Sadness			Fear		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
Autism group	22	.77	.43	17	.65	.49	17	.76	.44	13	.77	.44
Control group	22	1.00	.00	22	1.00	.00	19	.95	.23	16	.88	.34

Table 2 Mean number of references to social events as a function of Group and Emotion

	“When did you feel...?”											
	Happiness			Anger			Sadness			Fear		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
Autism group	19	.11	.32	15	.62	.49	15	.53	.52	12	.00	.00
Control group	22	.50	.51	22	.95	.21	18	.67	.49	13	.46	.52

illustrating sadness: “when I cannot tell the difference between people’s feelings”. Fear did not evoke any social illustrations in children with autism. Children from the control group referred again to bullying (4 times out of 7) or because they were worried about someone else’s well being (3 times). Overall, explaining negative emotions by being bullied or teased involved 25 and 40% of the social explanations in the autism group and the control group, respectively.

The third question asked for the intensity of the emotions indicated by our participants. Children who denied the experiences of an emotion on the first question were attributed a score of 0 for intensity. The maximum score for intensity was 5. A 2 (Group: Autism versus Control) \times 4 (Emotion: happiness, anger, sadness, fear) analysis of variance with repeated measures on the last factor showed no group-effects, but only a main effect for Emotion ($F(3,126) = 19.90$, $P \leq .001$). Happiness (mean = 4.48, $SD = 1.11$) was ascribed a stronger intensity than Anger (mean = 3.07, $SD = 1.80$), Sadness (mean = 2.68, $SD = 1.88$) or Fear (mean = 2.07, $SD = 2.00$) by both groups. The differences found seem to reflect a very common normative attitude to the emotions at this age: intense negative emotions—and especially fear—are more difficult to acknowledge than intense positive emotions (Saarni, 1999). Children with autism are clearly no exception. A post hoc *T*-test (Happiness versus Anger) confirmed this difference ($T(43) = 4.72$, $P < .001$). Anger was ascribed a stronger intensity than Fear ($T(43) = 2.77$, $P < .008$), but no other significant differences were found between the negative emotions. Bonferroni correction was applied.

Multiple Emotions

When looking at the number of emotional perspectives detected in the multiple emotion task, it appeared that

children with autism identified fewer different emotional perspectives per story (a mean number of 1.77 per story, out of a maximum of 4, versus 2.12 in the control group). A 2 (Group) \times 2 (Condition: PN versus NN) analysis of variance, with repeated measures on the last factor, sustained this conclusion: a main effect for Group ($F(1,42) = 4.64$, $P \leq .037$). No other significant results were found.

However, this result does not automatically imply that children with autism less often acknowledge a multiple emotional perspective, because it is possible to ascribe more than two emotional perspectives to the same multiple emotion scenario. Table 3 displays the mean frequencies for each condition (maximum = 2) in which the children of both groups reported such a multiple perspective (i.e. more than one emotional reaction). A score in the NN-condition indicates that children acknowledged at least two negative emotions, and a score within the PN-condition indicates the acknowledgement of at least one emotion of both valences. Seven children with autism never identified more than one emotion per story. All children from the control group identified more than one emotion simultaneously at least twice (out of four stories). A 2 (Group) \times 2 (Condition: PN versus NN) analysis of variance, with repeated measures on the last factor showed a main effect for Group ($F(1,42) = 8.73$, $P \leq .005$), Condition ($F(1,42) = 19.91$, $P \leq .001$) and an interaction for Group \times Condition ($F(1,42) = 4.34$, $P \leq .043$). It can be seen that children in both groups acknowledged the multiple perspective more often when it concerned two negative emotions. However, children with autism fell behind the control group in this negative–negative condition ($T = 3.68$, $df = 42$, $P \leq .001$), whereas this difference did not reach significance in the positive–negative condition ($T = .78$, $df = 42$, $P \leq .440$).

Table 4 displays how often each of the basic emotions appeared in reaction to the four scenarios

Table 3 Mean number of answers involving more than one emotion as a function of Group and Condition

	<i>n</i>	Positive–Negative		Negative–Negative	
		M	<i>SD</i>	M	<i>SD</i>
Autism group	22	.59	.73	.95	.90
Control group	22	.77	.81	1.77	.53

Table 4 Mean number of emotion perspectives as a function of Group and Emotion

	<i>n</i>	Happiness		Anger		Sadness		Fear	
		M	<i>SD</i>	M	<i>SD</i>	M	<i>SD</i>	M	<i>SD</i>
Autism group	22	1.36	1.40	1.77	1.15	2.86	.99	1.09	1.15
Control group	22	.95	.90	2.73	.88	3.77	.53	1.00	1.07

(maximum = 4). Given our previous consideration that the scenarios did not provide an equal opportunity to each emotion, a comparison between emotions becomes somewhat meaningless. However, in the light of the findings from the first task on single emotions, it is important to see whether children with autism referred less to a specific emotion when compared to the control group. A 2 (Group) \times 4 (Emotion: Happiness, Anger, Sadness, Fear) analysis of variance with repeated measures on Emotion, not only displayed a main effect for Emotion ($F(3,126) = 46.89$, $P \leq .001$), but also showed a main effect for Group ($F(1,42) = 4.64$, $P \leq .037$) and an interaction effect ($F(3,126) = 4.99$, $P \leq .003$). Post hoc *T*-tests showed that children with autism acknowledged the Anger and Sadness perspective less often than the control group ($T(42) = 3.09$, $P \leq .002$, and $T(42) = 3.80$, $P \leq .001$, respectively), whereas there were no differences for Fear and Happiness. Bonferroni correction was applied.

Finally, children were also asked about the intensity of the emotions they reported. The mean intensity attributed to Happiness and Fear did not differ between children with autism and the control group. However, with respect to the two emotions that children with autism identified less often, it appeared that, when they did identify them, they also attributed a lower intensity: 2.17 vs. 2.73 ($T(38) = 2.02$, $P \leq .025$) for Anger and 3.77 versus 3.00 ($T(41) = 3.84$, $P \leq .001$) for Sadness; on a scale from 0 to 5. Bonferroni correction was applied.

Discussion

A number of our findings fit well with the general expectation that children with autism are less aware of their own emotions. When we looked at the data collapsed across emotion, it was found that children with autism more often claimed not to feel an emotion (note that this was only for anger when tested separately for each emotion), were less able to generate emotionally charged situations from their own experience, provided fewer emotionally charged social situations (consistent with the study by Jaedicke et al., 1994), and acknowledged fewer different emotional perspectives in the multiple emotion scenarios. However, there are also a number of findings that can be used to shed light on the specific nature of the awareness problems: Why do children with autism detect fewer emotional perspectives only in the negatively charged multiple scenarios and not in the mixed charged ones? Why do they seem to feel the emotions they reported in the identification task with the same intensity as the control group? And

finally, what are the reasons for the emotion-specific differences that we find in both tasks?

The finding that children with autism are equally as good as the control group at detecting emotions of an opposite valence within one scenario but not in detecting emotions of the same valence, suggests that we cannot attribute their problems to a developmental delay. As we already mentioned in the introduction, all studies (Harter & Whitesell, 1989; Meerum Terwogt, & Olthof, 1989; Wintre & Valance, 1994) unequivocally indicate that the acknowledgement of simultaneous emotions of the same valence normally precedes the acknowledgement of simultaneous occurrence of opposite emotions. Young children find it difficult to accept that one and the same situation could elicit emotions that are the opposite. This is clearly not the case in children with autism, who accept the possibility of opposite perspectives and are able to report on them. Then, why is it that these high functioning children with autism make fewer reports of more than one negative emotion?

Children derive emotion concepts on the basis of the combined information of three sources: self-monitoring, the observation of others and the information provided by the (verbal) community (Harris & Olthof, 1982). The topic in this study concerns the first factor, but we already know that the second source of information is impaired in children with autism: they are known to neglect emotion signals in others (Begeer et al., 2006; Jennings, 1974; Weeks & Hobson, 1987). Additionally, their relative inexpressiveness (Attwood et al., 1988) makes it plausible that they also receive less—or at least less systematic—feedback from their environment, which involves the third factor. This combination of factors could make it more difficult to enable these children to link a well-developed concept of emotions to their own internal signals, even when they do detect these signals. We therefore suggest that they might be relatively poor at distinguishing emotions on the basis of their own experiences, as can also be found among adults with autism who reported a higher degree of alexithymia (Hill, Berthoz, & Frith, 2004). Emotions of the same valence share a larger conceptual overlap, which makes it more likely that they co-occur more often in everyday life. However, they are also more difficult to distinguish from one another than opposite emotions. If experiencing one or more negative emotions results in a vague notion, such as “I feel bad”, each of the negative emotion alternatives could cover this feeling. Nonetheless, it seems as if children with autism often limit themselves to one of these alternatives, since “bad” is experienced more often as a single and undivided feeling.

With respect to children's intensity judgements, the data from the first experiment showed that the autism group did not differ from the normally developing children. That suggests that their relative inability to differentiate between emotions does not affect their awareness of the strength of their reactions. The awareness problems in the autistic spectrum group seem to be limited to labelling their emotional reactions. Obviously, a comparison of absolute intensity is difficult, because one will use his or her own anchor-points for attributing the intensity-scores. Still, it could be concluded that children with autism discriminate between different levels of intensity equally well. They exhibit the same emotion specific intensity differences as their normal developing peers, suggesting that they are aware of some basic conventions concerning emotions among peers (Saarni, 1999). Happiness can be experienced without restraint. Intense fear (most respondents are boys) is not a reaction that one easily wants to admit. Sadness and anger are placed in-between in the sense that they are only justified on some occasions.

How do these results fit with the results of the second experiment? Again, intensity scores of happiness and fear were the same for both groups. This time, however, children from the autistic spectrum reported anger and sadness with less intensity. Moreover, the same two emotions were selected less often in comparison to the control group. Contrary to the first experiment, one could in the second experiment dismiss or disapprove of a certain perspective by attributing a lower intensity to an emotion. The low attention given to anger and sadness could be the result of a more dominant position of fear within the autistic conception of negative feelings when compared to the control group. We know that clinicians who work with and observe these children on a daily basis repeatedly give reports on fear reactions and it has also been argued that stress and anxiety play a crucial role in many behavioural problems of children with autism (Grodén, Cautela, Prince, & Berryman, 1994).

Fear is experienced as a threat to one's security or safety (Izard, 1991). A reason for a prominent position of fear can be found in the fact that children from the autistic spectrum find it difficult to get a grip on the (especially social) world. Their relatively weak theory of mind capacities interfere with a full understanding of other people's actions and reactions. Consequently, their perception of control could be low which will automatically elicit fear. That does not exclude the experience of anger or sadness in social situations, but those emotions (especially anger, which implies a certain feeling of competence to deal with the situation)

could be mostly experienced within very familiar situations. Indeed, the examples provided by the children in the first experiment showed that children with autism less often described social occasions in which anger was experienced and in which sadness was primarily experienced in the company of family members (instead of the peers that were frequently mentioned by the control group). Yet, these results were derived post-hoc and future studies will look into this issue more closely.

This leaves us with one more question: if fear is indeed a dominant feeling in children with autism why is that not reflected in the results of the first experiment? The autism group certainly did not provide more fear examples than the control group and social examples were completely absent. However, if we look at the position of fear in comparison with the other emotions, the control group seem to display a certain resistance to report fear examples from their own experiences, whereas the autism group reported as many examples as they did for happiness. The total absence of social examples among the children with autism could originate from another kind of resistance: fear is one of the emotions they know best, but producing a fear occasion could revive the emotion to some extent. Consequently, if you have to produce an example, you prefer to select one that did not affect you too much. If this assumption is true, the social domain is where we could expect fear with the highest intensity.

In conclusion, the outcomes of this study strongly suggest that children with autism have difficulties in identifying their own emotions. We argued that this might stem from a less developed emotion concept in these children, which causes an impaired capacity to differentiate between one's emotions within the negative spectrum. The finding that children with autism reported fewer coping strategies to deal with negative emotions (Rieffe, Triantafyllakos, & Meerum Terwogt, 2003) also indicates that these children might not have acquired well-developed knowledge about their own negative emotions. Instead of using multiple emotion perspectives, the outcomes of this study seemed to point more at a simpler, single emotion perspective within the negative domain, with a more prominent position of fear in children with autism than in normally developing children.

One possible objection to the findings in this study concerns the fact that no explicit verbal and nonverbal IQ indices were at hand, and only nonverbal measures for the clinical group were administered. Obviously, a limited verbal ability could have negatively affected the outcomes of this study. However, the fact that their

teachers, who see and work with these children on a day to day bases, carefully selected the children based on their verbal and nonverbal functioning in the classroom, does provide reasonable validity to the outcomes and prevented the children from extra—and perhaps unnecessary—testing outside their classroom.

Future studies should confirm these findings and look more closely into these issues. However, if the finding that children with autism seem to have less sophisticated notions about their own emotions and the nuances involved should be confirmed in future research, this would improve our understanding of the problems that these children face. For example, one of the implications of a less complex emotional experience is that one's focus will be limited to one of the many aspects that can be involved in emotionally laden situations. Consequently, this limited view will also prevent one from dealing with the situation in the most optimal manner. Finally, note that there is no reason to expect a different outcome for the positive spectrum, but this was not included in the current study because only the four basic emotions of happiness, fear, anger and sadness were incorporated.

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Appendix: Multiple Emotions Vignettes

Happiness/Sadness

Your best friend has been in the hospital for a long time. But now [s]he is home and you are going to play with him/her again for the first time since her illness. “Hi” [s]he says very cheerful when [s]he sees you. “It’s been a long time!” But [s]he still looks very pale. You can see [s]he is still in a lot of pain.

You are going out on a day-trip with your class. The teachers made up a very nice programme: first you will all go out and play in the woods. Then have a picnic. And in the afternoon you’re going to go to the zoo. But it turns out that it is very cold that day and it is going to rain and be windy all day.

Anger/Sadness

You are alone in the house with the babysitter. You are in the kitchen and then that cat, which followed you, pushes a beautiful glass bowl from the draining board. Bang! It is completely shattered. The babysitter comes in and shouts: “What have you done!” You shout back: “I didn’t do anything, it was the cat”. But

the babysitter doesn’t believe you. As a punishment, she sends you to your room. It is still very early in the evening, and all your friends are playing outside. From your bedroom, you can hear them laugh and having fun playing a game.

You made a nice ashtray of clay at school. You are pleased with it and how bright the colours are. You think: “I’ll give it to my sister. Sometimes, she smokes, so she will be happy with it”. You come home and give the astray to your sister. But your sister is in a bad mood and says “What do you want me to do with that stupid thing, I already have many ashtrays!”

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